Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:2151902   **Date:15/06/2022**
Subject Name:Theory of Machines
Time:02:30 PM TO 05:00 PM   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

                                                                    MARKS

Q.1	**(a)**	Describe dynamometer.	**03**
	(b)	Distinguish simple band brake and differential band brake.	**04**
	(c)	The connecting rod of an oil engine has a mass of 60 kg, the distance between the bearing centres is 1 metre. The diameter of the big end bearing is 120 mm and of the small end bearing is 75 mm. When suspended vertically with a knife-edge through the small end, it makes 100 oscillations in 190 seconds and with knife-edge through the big end it makes 100 oscillations in 165 seconds. Solve the moment of inertia of the rod in kg-m^2 and the distance of C.G. from the small end centre.	**07**
Q.2	**(a)**	Write the gyroscopic effect on ship during pitching.	**03**
	(b)	Conclude the concept of gyroscopic couple.	**04**
	(c)	An aero plane makes a half circle of 100 m radius, towards left when flying at 400 km/hr. The engine and propeller of plane weights 500 kg and has a radius of gyration of 30 cm. The engine rotates at 3000 r.p.m. anticlockwise when viewed from front end. Solve the gyroscopic couple and its effect on aero plane.	**07**

OR

	(c)	Develop stability of two-wheel vehicle moving in curved path with neat sketch.	**07**
Q.3	**(a)**	Define:(1) Fluctuation of energy (2) Maximum fluctuation of speed (3) Co efficient of fluctuation of energy	**03**
	(b)	Explain Watt governor with the help of neat sketch.	**04**
	(c)	The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1 mm to 500 N-m torque and 1 mm to 6° of crank displacement. The intercepted areas between output torque curve and mean resistance line taken in order from one end, in sq. mm are – 30, + 410, – 280, + 320, – 330, + 250, – 360, + 280, – 260 sq. mm, when the engine is running at 800 r.p.m. The engine has a stroke of 300 mm and the fluctuation of speed is not to exceed ± 2% of the mean speed. Solve a suitable diameter and cross-section of the flywheel rim for a limiting value of the safe centrifugal stress of 7 MPa. The material density may be assumed as 7200 kg/m^3. The width of the rim is to be 5 times the thickness.	**07**

<div align="center">**OR**</div>

Q.3	**(a)**	Define: (1) Flywheel (2) Maximum fluctuation of energy (3) Co-efficient of fluctuation of speed	**03**
	(b)	Explain Porter governor with the help of neat sketch.	**04**
	(c)	A punching press is driven by a constant torque electric motor. The press is provided with a flywheel that rotates at maximum speed of 225 r.p.m. The radius of gyration of the flywheel is 0.5 m. The press punches 720 holes per hour; each punching operation takes 2 second and requires 15 kN-m of energy. Solve the power of the motor and the minimum mass of the flywheel if speed of the same is not to fall below 200 r. p. m.	**07**
Q.4	**(a)**	Classify clutch.	**03**
	(b)	Explain Prony brake dynamometer.	**04**
	(c)	A plate clutch consists of one pair of contacting surfaces. The inner and outer diameters of the friction disk are 100 and 200 mm respectively. The coefficient of friction is 0.2 and the permissible intensity of pressure is 1 N/mm^2. Assuming uniform-wear theory, Determine the power-transmitting capacity of the clutch at 750 rpm.	**07**

<div align="center">**OR**</div>

Q.4	**(a)**	Classify brake.	**03**
	(b)	Explain epicyclic train dynamometer.	**04**
	(c)	Evaluate braking torque of an internal expanding shoe brake with the help of neat sketch.	**07**
Q.5	**(a)**	Describe equilibrium of two force and three force system.	**03**
	(b)	Explain D'Alembert's Principle.	**04**
	(c)	Analyze of dynamics force analysis of four bar mechanism	**07**

<div align="center">**OR**</div>

Q.5	**(a)**	Describe Newton's law of motion.	**03**
	(b)	Explain Impulse and Momentum.	**04**
	(c)	Analyze of static force analysis with friction in turning pairs.	**07**

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